Research Focus

Exploration of the hardware and software infrastructure required to support the personal server concept.

Research at Intel
Ubiquity

Ubiquity is a collaboration between the Ubiquity Research Team, Intel's Emerging Platforms Lab (EPL), the Mobile Platforms Group (MPG), and Intel Research Seattle, to explore the emerging research area of ubiquitous computing. The project focuses on the personal server concept: a small, mobile device that is designed to hold all of its user's personal information.

The device has no physical input/output capabilities. Rather, it links wirelessly to displays and other I/O devices in the local environment, enabling users to access the contents of the device wherever they travel. Essentially, it enables any computer, with a small amount of additional software installed, to perform as if it were the user's own computer. The ultimate goal is to reduce the burden of mobile computing, in terms of weight and display limitations, and still provide the user with a first-class mobile experience.

The Ubiquity team is exploring the hardware and software infrastructure required to develop the personal server concept. The team's research also supports another Intel Research project exploring robotics, and has connections to a number of research activities that use the popular wireless sensor nodes (called "Motes") developed at Intel Research Berkeley in cooperation with UC Berkeley. In close collaboration with the Ubiquity research project, Intel Research Seattle is building a "watch-like" peripheral that can be used to control the personal server with a radio link using a technique they call "TiltType." TiltType is a method of entering text on a small computer by tilting it from side to side and front to back.

In addition to basic research, the Ubiquity research team is contributing to the broader research community through publications in premier conferences, workshops, technical program committees, and collaborations with top-tier universities (currently, with the University of Washington, UC Berkeley, and the Georgia Institute of Technology).

Research Agenda

A variety of projects are being carried out in support of the personal server concept.

Personal Server Hardware

Our team has built several prototype devices and supporting infrastructure based on the Intel® XScale™ microarchitecture, featuring Intel® StrongARM* technology. These prototypes include a radio with *Bluetooth** wireless technology and high-density storage to provide always-available access to large quantities of personal data. Since the device does not require an on-board LCD display or bulky input device, it can easily fit in a purse or pocket.

Hardware Platform v2.1

Power Management

For the personal server to be useful and responsive it must be "always on" but conserving power and consuming the lowest possible power when not in use. The goal of this project is to manage power usage on the device so that it typically requires only infrequent (say, weekly) recharging. A related project explores low-power discovery mechanisms to enable the personal server to quickly identify, authenticate and communicate with services in the local environment. For example, it could enable an automatic payment service in a movie theater.

Peripheral Devices

The team is exploring concept peripherals that can wirelessly attach to the personal server. These devices, such as a key-chain remote control fob or watch with a scroll wheel or navigation buttons, will allow users to interact with information at a distance, utilizing large-screen public displays to their maximum. Additionally, advanced interface elements like authentication rings and personal medical sensors, can seamlessly communicate with the personal server, utilizing its advanced computation and storage capabilities.

Remote Scroll Wheel

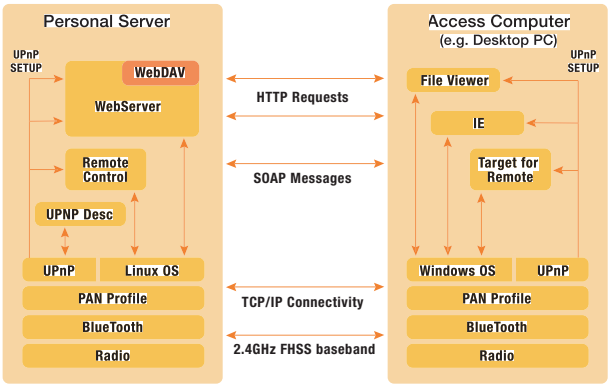
Applications Development

Personalization is one of the major themes for personal server applications: for example, automatic configuration of speed dial numbers on a telephone or radio station preferences in a rental car based on user profiles stored in the personal server. Another application is serendipitous data capture, such as a discount coupon automatically received from an information beacon as a user walks past a store window, or remote control of a public display allowing it to be customized with your own data. We're examining other possibilities, as well, including health-monitoring applications.

Prototype Personal Server

Software Infrastructure

This project focuses on the software components that must be installed in the local infrastructure to enable it to communicate with the personal server. Seamless interoperation with existing standards and software base will greatly increase the chance of the system's adoption. By automating the steps necessary to interact with a personal server, operating the device can become a natural part of every day computing. Privacy is a primary consideration in this space, however, requiring a tricky balance between information sharing and protection. We feel it is essential to protect a user's privacy while enabling novel functionality.



Personal Server Software Architecture Diagram

People

Project Leader: Roy Want, Ph.D.

Roy Want is a Principal Engineer at Intel. He is the developer of the personal server concept and leader of the Ubiquity Project. Dr. Want received his B.A. and Ph.D. in Computer Science from Cambridge University. He is the author or co-author of more than 35 publications in the areas of mobile computing, distributed systems, wireless protocols, multimedia systems and electronic identification. He also holds 45 patents in these areas.

For the decade prior to joining Intel, Dr. Want was a member of the research staff at Xerox Palo Alto Research Center (PARC). Among other research efforts, he led the PARCTAB project and built one of the first context-aware computers. While at Olivetti Research (1988-91), he developed the Active Badge, a system for locating people within a building using infrared signaling.

Research Team

The Ubiquity Research team (below) works collaboratively with Gunner Danneels and Muthu Kumar of Intel's Emerging Platforms Lab (EPL); Jim Kardach and Graham Kirby of Intel's Mobile Platforms Group (MPG); Adam Rea of the University of Washington; and Gaetano Borriello, Ken Fishkin, and Anthony LaMarca of Intel Research Seattle.

Ubiquity Research Team, Santa Clara: Alex Nguyen, Trevor Pering, Roy Want

Ubiquity Research Team, Oregon: Murali Sundar, John Light

About Intel Research

In a future world of proactive computing, billions of tiny, powerful, connected devices throughout the environment will anticipate our needs and take appropriate action on our behalf. With the formation of Intel Research in 1999, Intel began funding research into the emerging and disruptive technologies required to translate this vision into reality.

Intel has initiated several projects in support of proactive computing. A number of strategic research projects are being carried out internally, within Intel's research and development labs. These projects cover a broad range of disciplines, including MEMS, precision biology, ad hoc networks, extreme networked systems, ubiquitous computing, novel storage, live databases, statistical models, computational nanovision, robotics, machine learning, supply chain visualization, distraction-free systems, proactive healthcare, and ethnography.

Complementary research into proactive computing is being conducted externally through the Intel Research Network of labs, an innovative partnering between industry and academia. The labs, located near major universities, are wholly owned and funded by Intel but operate using a uniquely open and collaborative model. Much of the research they generate will be published and shared widely. Currently there are four labs in the network, in Berkeley, Pittsburgh, Seattle and Cambridge, England.

The Intel Research Network of labs builds upon Intel's strong history of research and development, both within the company and through more than 250 funded university projects throughout the world. Intel also supports research institutions through a variety of programs, including Intel forums, visiting faculty collaboration, and joint Intel-university research projects. Intel is an active participant in Sematech, the Semiconductor Research Corporation, and other industry consortia.

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